GRAFTING BOTH ACUTE WOUND SITE AND ADJACENT DONOR SITE WITH THE SAME GRAFT: AN EASY AND SAFE PROCEDURE TO IMPROVE HEALING AND MINIMIZE PAIN IN ELDERLY AND BEDRIDDEN PATIENTS

UNE MÉTHODE ALTERNATIVE POUR AMÉLIORER LA CICATRISATION ET DIMINUER LES DOULEURS DU SITE DONNEUR DE GREFFE DE PEAU MINCE CHEZ LES PATIENTS ÂGÉS ET GRABATAIRES: GREFFER LA BRÛLURE ET LE SITE DONNEUR ADJACENT PAR LE MÊME GREFFON

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SUMMARY. In harvesting skin to cover the defect caused by a burn, a second wound is created, the donor site wound. We propose an alternative method to manage the donor site: taking a split-thickness skin graft (STSG) from a donor site adjacent to the burn wound to be treated, and meshing at a 3:1 ratio to cover both sites at once. The main objective of this study is to evaluate the effectiveness of covering both burn wound and adjacent donor site with the same STSG in elderly and bedridden patients. We retrospectively reviewed the medical records of 6 patients over 60 years old or/and bedridden presenting with a small burn wound who underwent STSG of both burn wound and adjacent donor site between April 2016 and November 2016 in the Department of Plastic Surgery and Burn Treatment at Percy Military Hospital (France). Their data were compared with data of five patients who had undergone the usual STSG procedure during the same period. There was a statistically significant difference between patients who underwent adjacent STSG procedure and those who underwent usual STSG procedure in healing time (days) mean (SD) (7,33 ± 1,03 vs. 16,2 ± 0,83; p = 0,007) and Numeric Rating Scale pain mean (SD) at day 2 (0,33 ± 0,33 vs. 2,4 ± 1,35; p = 0,04). Grafting both acute burn wound and adjacent donor site with the same graft seems to be an easy method to improve healing and minimize pain in the STSG donor site in elderly and bedridden patients.

Keywords: split-thickness skin graft donor site, small wound burn, adjacent skin grafting, elderly patients, bedridden patients, mean healing time, mean pain scale

***RÉSUMÉ**. Lors du prélèvement de peau mince pour couvrir une plaie causée par une brûlure, une seconde plaie est créée, le site donneur. Voici une méthode alternative pour la gestion du site donneur: prélever une greffe de peau mince GPM à partir d'un site donneur adjacent à la brûlure, l'expandre avec un ratio de 3:1 pour couvrir les deux sites à la fois. Ici l'objectif principal est d'évaluer l'efficacité de la couverture simultanée d'une petite brûlure et du site donneur adjacent avec la même GPM chez les patients âgés et alités. Nous avons étudié rétrospectivement les dossiers de 6 patients traités par couverture simultanée de la brûlure et du site donneur adjacent avec la même GPM entre avril 2016 et novembre 2016 dans le Service de Chirurgie Plastique de l'hôpital militaire Percy (France). Les données ont été comparées à un groupe similaire de patients qui ont subi une procédure habituelle durant la même période. Il y avait une différence statistiquement significative entre les patients qui ont subi une procédure de GPM du site donneur adjacent et ceux qui ont subi une procédure habituelle sur la durée (jours) moyenne (écart-type, SD) de cicatrisation (7,33 ± 1,03 vs 16,2 ± 0,83; p = 0,007) et de la douleur sur l'échelle numérique au jour 2 (0,33 ± 0,33 vs 2,4 ± 1,35; p = 0,04). Greffer la plaie liée à la brûlure aiguë et le site donneur adjacent avec une même GPM semble être une méthode simple pour améliorer la guérison et minimiser la douleur du site donneur.*

***Mot-clés:** greffe de peau mince, petite brûlure, greffe de peau adjacente, personnes âgées, patients à mobilité réduite, temps moyen de cicatrisation, échelle moyenne de la douleur*

Introduction

Treatment of the split-thickness skin graft donor site (STSGDS) is a topic of debate. In harvesting skin to cover the defect caused by a burn, a second wound is created, the donor site wound. Usually, re-epithelialization of this wound occurs

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Manuscript: submitted 31/01/2017, accepted 26/02/2017.

in 10 to 15 days. Many controversies continue about the character of donor sites after healing and no standard method has been established to manage these wounds. Generally, donor-site dressings can be categorized as open, semi-open, occlusive, semi-occlusive and biological. In any case, the method chosen to treat the donor site should consider the individual circumstances of each patient, such as age, health status and skin condition. Donor site wound dressings should be pain-free, reduce blood loss and not be changed until the wound has healed.[1,2] A pain-free dressing is the most consistently desirable, in recognition of the fact that the donor site wound is often more painful than the recipient site.[3] In addition, nowadays cost-effectiveness is becoming an important issue in wound management, requiring judicious use. Currently, the alginate dressing seems to be preferred in French practices due to its ease of use, its absence of change (reduces pain by limiting manipulations) and its moderate cost.[4]

Another biologic dressing that can be used is split-thickness skin graft (STSG). STSG is widely used for achieving skin coverage donor sites in burns that are not predicted to heal rapidly with alginate dressings, especially in elderly and bedridden patients.[5] Age over 60 is a significant risk factor as well as diabetes and paraplegia.[6] This method was described in 1960 by Thompson et al.[7] Recently, a randomized study published by Bian et al[8] showed that regrafting STSG on the donor site shortens epithelialization time (around 9 days), reduces pain and prevents hyperplastic scar formation.

However, in elderly and bedridden patients the choice of donor site is often a problem for postoperative care. Choosing a donor site adjacent to the burn wound could be a good alternative. We propose an alternative method for donor site management: taking an STSG from a donor site adjacent to the burn wound to be treated, and meshing at a 3:1 ratio to cover both sites at once.

The main objective of the present study is to evaluate the effectiveness of covering both burn wound and adjacent donor site with the same STSG in elderly and bedridden patients.

Patients and methods

We retrospectively reviewed the medical records of patients presenting with a small burn wound who underwent split-thickness skin grafting of both burn wound and adjacent donor site between April 2016 and November 2016. The study samples were collected from the Department of Plastic Surgery and Burn Treatment at the Percy Military Hospital (France). The inclusion criteria were: the presence of a burn wound classified as second or third-degree affecting less than 3% of the body surface, patient age over 60 years or/and bedridden, surgical indication of STSG to cover the burn wound, able to communicate effectively, hospital stay of at least 3 days to measure pain score, and informed consent from the patient. The diagnosis of burn was established on clinical examination. Burn wound depth was classified using the usual burn classification. A bedridden patient was defined as a patient that had to stay in bed or seated for a long period of time for medical reasons such as cancer or medullar trauma. Age over 60 years and being bedridden were considered as high risk factors of delayed donor site healing. Exclusion criteria were: non French-speaker, hallucinations, delirium, Alzheimer's disorders, critical condition requiring sedation, and burns caused by chemicals, electricity or radiation.

Fig. 1- The top photo shows where the STSG was taken from. A 61-year-old patient (case 1) with a third-degree burn wound on her left thigh underwent the adjacent STSG procedure. The initial donor site adjacent to the burn wound is identified in dark grey, and the burn wound to be covered in light grey. In the bottom photo, an STSG has been meshed at a ratio of 3:1 and placed over both donor site and burn wound.

Before surgery, all patients underwent a clinical examination and pictures of the wound were taken. Our alternative method for donor site grafting in these patients at high risk of delayed wound healing was conducted as follows (*Fig. 1*): an STSG was harvested in the usual manner with an Aesculap® dermatome adjacent to the burn wound. A 0.4 mm thickness STSG was harvested. This STSG was meshed at a 3:1 ratio with Inomed® skin graft mesher. The STSG was then placed for burn wound coverage after its excision to make sure we had harvested the correct size. Finally, the graft was placed over both STSG donor site and burn wound, covering the wound entirely. The graft was affixed with wide skin staples on the side and in the middle and then covered with Jelonet® paraffin gauze dressing for 5 to 7 days, and was changed every two days. After the procedure, patients were analyzed for wound healing time at week 1, week 2 and one month. Healing pain was analyzed at day 1, 2, 3 and 4. The measure used in this study included a Numeric Rating Scale (NRS) for pain. An 11-point numeric scale with 0 representing one pain extreme ('no pain') and 10 representing the other pain extreme ('pain as bad as you can imagine' and 'worst pain imaginable'). The patient was asked to make three pain ratings, corresponding to current, best and worst pain experienced over the past 24 hours. The average of the 3 ratings was used to represent the patient's level of pain over the previous 24 hours. The NRS is quick, easy to use and easy to score, and it provides a method to compare the findings to previous results.

The NRS also provides ratio-level data, allowing more robust parametric statistical analysis. Concurrent validity of the NRS to measure the self-report of anxiety has been demonstrated when scores were compared with Spielberger's (1983)

State Anxiety Inventory.[9] Healing complications and dressing cost were also analyzed. We defined complications as graft failure, hematoma, or infection for the donor site and burn wound, and hyperplastic scar at one month. Informed consent was obtained from all patients before surgery.

The primary endpoint was to determine mean donor site healing time in patients who underwent an adjacent STSG donor site procedure. Secondary endpoints were to determine mean NRS pain after surgery at day 1, 2 and 3, healing complications, healing cost and cosmetic appearance in patients who underwent an adjacent STSG donor site procedure. In addition, data were compared with a similar group of patients who underwent the usual procedure during the same period in our department as follows: STSG harvested with a donor site distant from the burn wound. STSG was then used to cover the burn wound. Burn wound and donor site were covered with two different dressings: respectively with Jelonet® paraffin gauze dressing and Algosteril® alginate dressing. Algosteril® alginate dressing was soaked with two phials of 20 mL of L-bupivacaine 5 mg/mL. After surgery, all patients received similar antalgic drugs. Thus, there is no bias around this point.

P values for the analysis of the primary and secondary endpoints were obtained using the Welch's t-test, with $p < 0.05$ considered statistically significant.

Results

Six patients were included. Analysis of the patients' characteristics (*Table I*) showed that the average age was 57 ± 18,2 years (mean ± standard deviation). In fact, all except two patients were over 60 years old: one was 25 years old and had paraplegia, the other was 40 years old and alcohol dependent. Five patients were included in the usual STSG procedure group. In addition, the comparison of the adjacent STSG procedure group with the usual STSG procedure group showed no significant differences. No differences were found for any of the demographic characteristics, age, ethnicity and anesthesia except for gender. For this difference we have no explanation.

Concerning the primary endpoint, mean (standard deviation, SD) healing time (days) in the adjacent STSG procedure group was 7,33 ± 1,03 (*Table II and Fig. 2*). Of the six patients that underwent this procedure, none had any reported wound healing complications, including graft failure, hematoma or infection. Early grafting had a meshed appearance and only required staple removal at day 5 or 6 (*Fig. 2*). Examination of the grafts postoperatively showed normal wound healing and graft acceptance. One month postoperatively the graft had healed well with acceptable cosmetic outcome (*Figs. 3 and 4*).

Mean (SD) NRS pain in the adjacent STSG procedure group was 1 (1,4) at day 1, 0,33 (0,33) at day 2 and 0 at days 3 and 4. Concerning secondary endpoints, there was a statistically significant difference in mean healing time between patients who underwent an adjacent STSG procedure (7,33 ± 1,03) and those who underwent a usual STSG procedure (16,2 ± 0,83, p = 0,007) (*Table II*). There was a statistically significant difference in mean NRS pain (SD) only at day 2 between patients who underwent an adjacent STSG procedure (0,33 ± 0,33) and those who underwent a usual STSG procedure (1,4 ± 1,35, p = 0,04) (*Table II*). Analgesic intake was compared

Table I - Characteristics of the study population

STUDY POPULATION	Adjacent STSG procedure group	Usual STSG procedure group
Male (%)	16,6°	60
Female (%)	83,3°	40
Age (years) mean (SD)	57 (18,2)	62,2 (4,3)
ETHNICITY (%)		
European	83,3°	70
African	16,6°	30
Asian	0	0
ANESTHESIA (%)		
General	100	100
Local	0	0
PARTICULARITIES (%)		
Over 60	66,7°	100
Paraplegia	16,6°	0
Alcohol dependence	16,6°	0

SD: Standard Deviation
°Percentages are rounded, they do not always lead to a total of 100

Table II - Secondary outcomes: mean donor site healing time, mean Numeric Rating Scale (NRS) for pain after surgery at day 2 and comparison between patients who underwent an adjacent STSG donor site procedure and those who underwent the usual procedure

	Adjacent STSG procedure group	Usual STSG procedure group	
Mean (SD) time (days) to complete healing	7,33 ± 1,03°	16,2 ± 0,83	p = 0,007
Mean NRS pain at day 2	0,33 ± 0,33°	2,4 ± 1,35°	p = 0,04

SD: Standard Deviation
°The more or less correspond to mean values +/- standard deviation

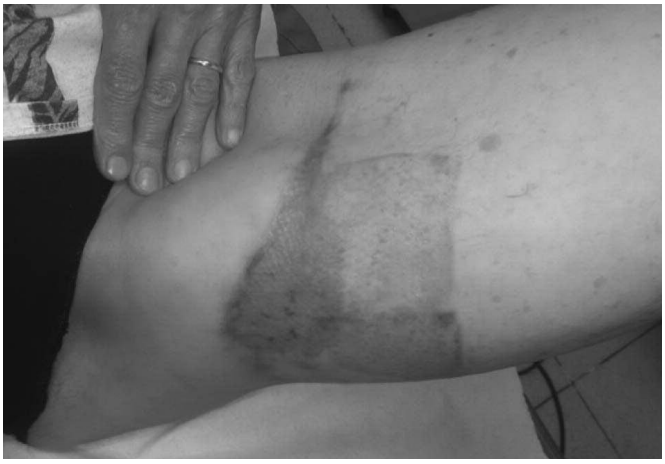

Fig. 2 - Case 1 at 10 days.

Fig. 3 - Case 1 at one month.

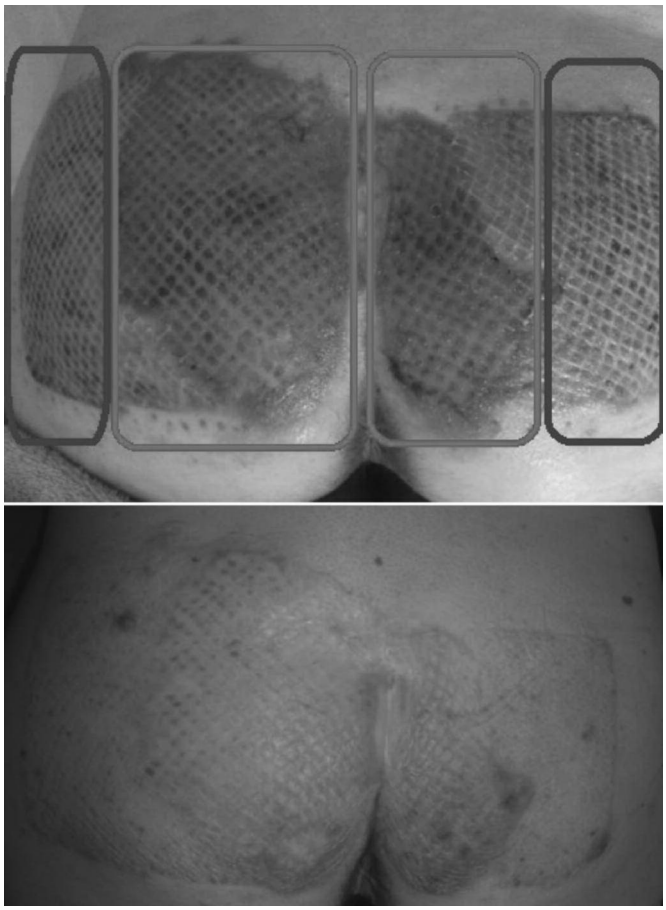

Fig. 4 - Case 4, 11 days after surgery (top photo) and at six months after surgery (bottom photo). Burn wound on her back. The initial donor site adjacent to the burn wound is identified in dark grey, and the burn wound that was covered in light grey.

Table III - Information about pain medications received in each group

	Analgesic drugs	Adjacent STSG procedure group	Usual STSG procedure group	p
Day 1	Paracetamol (g/day) (SD)	3.16 (0.75)	3.6 (0.54)	Ns
	Morphine sulfate (mg/day) (SD)	26.66 (5.16)	24 (5.47)	Ns
Day 2	Paracetamol (g/day) (SD)	2.83 (0.75)	3.2 (0.74)	Ns
	Morphine sulfate (mg/day) (SD)	13.33 (5.16)	14 (4.89)	Ns
Day 3	Paracetamol (g/day) (SD)	2.83 (0.75)	3.2 (0.83)	Ns
	Morphine sulfate (mg/day) (SD)	5 (4.47)	9 (2.23)	Ns
Day 4	Paracetamol (g/day) (SD)	2.5 (0.54)	2.6 (0.54)	Ns
	Morphine sulfate (mg/day) (SD)	1.66 (2.58)	2 (2.73)	Ns

p: p value
ns: not significant
SD: Standard Deviation

between the adjacent STSG procedure group and the usual STSG procedure group. No significant difference was found for paracetamol and morphine intake between the two groups (*Table III*). Average time between accident and grafting procedure was similar: 5,5 (1,51) in the adjacent STSG procedure group and 5,8 (0,83) in the usual STSG procedure group (p = 0,90). Concerning wound status at time of grafting, no clinical evidence of infection was noticed. No wound culture was done as all patients had wounds affecting small areas of the body surface with no clinical evidence of infection.

One week of dressing for a patient who had undergone the adjacent STSG procedure cost 64 euros instead of 89,5 euros for a patient who had undergone the usual STSG procedure. Finally, this procedure allowed only one dressing change instead of two. This gave more comfort for the patient and the nurses of our department.

Discussion

In this study, covering both burn wound and adjacent donor site with the same STSG in elderly and bedridden patients seems to improve donor site healing and minimize pain. We noted a statistically significant difference in healing time and NRS pain at day 2 between patients who underwent an adjacent STSG procedure and those who underwent a usual STSG procedure.

Our results are consistent with studies on pain assessment in patients undergoing split-thickness skin grafting to achieve skin coverage donor sites.[10] Bian et al. showed that pain in patients undergoing split-thickness skin grafting to achieve skin coverage donor sites mainly occurred around day 2 and 5 and that mean pain is around 1,9 ± 0,8. These results are similar to ours.

To our knowledge, this survey is the first to study the effectiveness of covering both burn wound and adjacent donor site with the same STSG in elderly and bedridden patients. Goverman et al. showed a method of STSG donor site management involving an identical graft harvested immediately adjacent to the primary graft donor site, meshing the graft 4:1, and placing it over both donor sites after extensive meshing to facilitate reepithelialization. In the study by Goverman et al., two STSGs were harvested from two donor sites: one STSG for burn wound coverage and one STSG to cover the two donor sites. In our method, only one STSG was taken from a donor site adjacent to the burn wound to be treated, and meshed at a 3:1 ratio to cover both sites at once.

Using STSG to achieve skin coverage donor sites in burns is a method that reduces hypertrophic scar formation. Hypertrophic scar formation is linked to focal adhesions kinase (FAK) signaling causing excessive fibrosis. It has been shown that FAK signaling increased with mechanical force on a wound, and that inhibition of FAK signaling inhibits hypertrophic scar formation through this mechanism.[11,12] Reducing the mechanical force on a wound by reducing the need to contract results in less hypertrophic scarring. Part of the goal of skin grafting is to reduce this mechanical load to allow better wound healing.[13,14]

In our study, no case of hypertrophic scar was found from April 2016 to November 2016. At one month postoperatively, all the grafts had healed well with acceptable cosmetic outcome. The adjacent STSG procedure is suited to elderly and bedridden patients with a burn wound classified as second or third-degree affecting small areas of the body surface with surgical indication. This procedure should not be used for young patients because grafting has a somewhat meshed appearance with a mediocre cosmetic outcome, especially in women patients. This procedure can only be used for limited burn wound surfaces with burn-free skin surrounding the wound.

Conclusion

In conclusion, grafting both an acute burn wound and adjacent donor site with the same graft seems to be an easy, inexpensive method to improve healing and minimize pain in the split-thickness skin graft donor site in elderly and bedridden patients. An interventional study is needed to confirm these results.

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Acknowledgements. We would like to acknowledge H. Keilani and A. Jambon for their help with statistics and iconographic work.

Conflict of interest. The authors declare that they have no conflict of interest related to this article.